Electronic Version
Stylesheet Version v1.1.1

Claims

[c1] What is claimed is:

1. A method for symbol timing synchronization in an orthogonal frequency division multiplexing (OFDM)communication system, the method comprising:
(a) converting a time domain digital signal to a corresponding frequency domain digital signal;
(b) calculating phase angles of tones of at least one symbol of the frequency domain digital signal when a symbol timing offset exists;
(c) calculating at least one differential phase offset (DPO), which is the difference between two consecutive gaps, wherein a gap is the difference between the phase angle of a tone of the symbol of the frequency domain digital signal when the timing offset of the symbol exists and a correct phase angle of the tone of the symbol of the frequency domain digital signal; and
(d) estimating the symbol timing offset with at least one DPO.

[c2] 2. The method of claim 1 further comprising removing a cyclic prefix and/or suffix from between contiguous symbols before converting the time domain digital signal

to the corresponding frequency domain digital signal.

[c3] 3. The method of claim 1 wherein the calculations of the gaps and the DPOs are performed with mod 2π arithmetic, the values of the gaps and the DPOs being within the range of 0 to 2π.

[c4] 4. The method of claim 1 wherein estimating the symbol timing offset comprises utilizing amean of a group of DPOs.

[c5] 5. The method of claim 1 wherein estimating the symbol timing offset comprises utilizing a medianof a group of DPOs.

[c6] 6. The method of claim 1 wherein estimating the symbol timing offset comprises utilizing ahistogram of a group of DPOs.

[c7] 7. The method of claim 6 wherein obtaining the histogram comprises steps of:
(e) dividing the interval 0 to 2π into a plurality of sub intervals; and
(f) counting the number of DPOs that fall into each sub interval.

[c8] 8. The method of claim 7 wherein utilizing the histogram to estimate the symbol timing offset further comprises

selecting a median of the range represented by the sub interval that the most DPOs fall into as the symbol timing offset.

[c9] 9. The method of claim 7 wherein the sizes of each sub interval are equal.

[c10] 10. A symbol timing synchronization systemfor an orthogonal frequency division multiplexing (OFDM)communication system, the signal detection system comprising:
a serial-to-parallel converter capable of performing serial-to-parallel conversion on an input time domain digital signal;
a fast Fourier transform (FFT)moduleelectrically connected to the serial-to-parallel converter for transforming the time domain digital signal into a frequency domain digital signal; and
a demodulator electrically connected to the FFT module comprising:
a symbol timing offset estimator comprising:
a phase calculator electrically connected to the FFT module for calculating phase angles of tones of at least one symbol of the frequency domain digital signal output from the FFT module when a symbol timing offset exists;
a phase offset calculator electrically connected to the phase calculator for calculating at least one differential

phase offset (DPO), which is the difference between two consecutive gaps, wherein a gap is the difference between the phase angle of a tone of the symbol of the frequency domain digital signal when the timing offset of the symbol exists and a correct phase angle of the tone of the symbol of the frequency domain digital signal; and

an estimating module electrically connected to the phase offset calculator capable of utilizing the at least one DPO to estimate the symbol timing offset; and

a demodulation module for demodulating the frequency domain digital signal.

[c11] 11. The symbol timing synchronization system in claim 10 wherein the estimating module is capable of calculating a mean of a group of DPOs and utilizing the mean to estimate the symbol timing offset.

[c12] 12. The symbol timing synchronization system in claim 10 wherein the estimating module is capable of calculating a median of a group of DPOs and utilizing the median to estimate the symbol timing offset.

[c13] 13. The symbol timing synchronization system in claim 10 wherein the estimating module is capable of generating a histogram of a group of DPOs and utilizing the histogram to estimate the symbol timing offset.

[c14] 14. The symbol timing synchronization system in claim 10 wherein the serial-to-parallel converter is capable of removing a prefix and/or suffix from between symbols.